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REVISION OF THE SOUTHWEST PACIFIC SPECIES OF MORUM (ONISCIDIA) (GASTROPODA : CASSIDAE)

A. G. BEU

New Zealand Geological Survey, DSIR, Lower Hutt, New Zealand

SUMMARY

Comparison of a specimen of Morum (Oniscidia) bruuni (Powell) collected alive off Raoul I., Kermadec Islands, with the holotype of Pulchroniscia delecta Garrard, 1961, from New South Wales, showed that the latter falls within the variation of the Kermadec Islands species. Like other species of Morum and subgenus Oniscidia, the type species of Pulchroniscia Garrard, 1961, has a disproportionately small head and operculum and lacks a radula. Pulchroniscia Garrard, 1961, is synonymised with Oniscidia Mörch, 1852. Morum (Oniscidia) grande (A. Adams, 1855) and Morum (Herculea) ponderosum (Hanley, 1858) are recorded from Queensland.

INTRODUCTION

While on a visit to Raoul Island, Kermadec Islands, during 1975, on R.V. "Acheron", Mr. A. J. Black dredged at 10 stations in depths of 27 to 550 m and brought to light many useful specimens and valuable new records of Mollusca, as well as of other phyla, all of which have been presented to the National Museum, Wellington, New Zealand. Among the material is a specimen of Morum (Oniscidia) bruuni (Powell), collected alive off Fleetwood Bluff, and agreeing closely in detail with the holotype, the sole previously known specimen, collected empty off Raoul Island by the "Galathea" Expedition (Powell 1958: 80). Comparison of specimens showed that Pulchroniscia delecta Garrard, 1961. named from a single empty shell trawled off New South Wales by the prawn investigation trawler "Challenge", also agrees in detail with the Kermadec Islands shell. Therefore Pulchroniscia delecta is a synonym of Morum (Oniscidia) bruuni, and an animal of P. delecta is available. The opportunity is taken to describe some of the gross anatomical features of M. brunni, in order to follow up the comments by Dance and Emerson (1967: 96) on the unknown anatomical features, and thus taxonomic status, of Pulchroniscia. The name of the only other species of Morum (Oniscidia) known to occur in Australia is clarified also.

TAXONOMY

Family Cassidae Subfamily Cassinae Genus Morum Röding, 1798

Morum Röding, 1798: 53. Type species (by monotypy): Morum purpureum Röding, 1798 (= Strombus oniscus Linnaeus, 1767), Recent, Caribbean. Oniscia G. B. Sowerby I, 1824: 1, pl. 233. Type species (by subsequent designation, Herrmannsen, 1847): Strombus oniscus Linnaeus, 1767.

Theliostoma G. B. Sowerby I, 1824: 2 (nomen nudum).

Oniscidia Swainson, 1840: 299 (incorrect subsequent spelling of Oniscia G. B. Sowerby I, 1824). Ersina "1840" Gray, 1847: 137 (unavailable; in synonymy of Morum Röding).

Plesioniscia Fischer, 1884: 660. Type species (by original designation): Oniscia tuberculosa "Sowerby, 1824" (nomen nudum) = Oniscia tuberculosa Reeve, 1842, ex Sowerby MS, Recent, Panamic western America.

The recent practice of Southern Hemisphere workers has been to regard Oniscidia "Swainson" Mörch as a full genus, differing from Morum in its larger size, taller spire, more prominent sculpture of cancellate pattern, and the presence of prominent axial ribs. However, it appears that the two groups intergrade in most features. Dance and Emerson (1967: pl. 13, fig. 1-3) figured the Caribbean *M. strombiformis* (Reeve), which they placed in subgenus Morum (Cancellomorum) (= Oniscidia) because of its relatively tall spire and relatively prominent axial ribs. Morum strombiformis resembles *M. oniscus* (Linneaus) closely in its juvenile stage but resembles species of Oniscidia in some features when mature. The writer regards *M. strombiformis* as a species of Morum (s. str.), differing from species of Oniscidia to those of Morum Clench and Abbott (1943: 4-5) described the operculum of Morum oniscus (Linneaus) as oval and disproportionately small, with nucleus near the margin, features agreeing with those of *M. (Oniscidia) bruuni* described below. Also Dr. W. K. Emerson (in *litt*, 1 Sept. 1972) stated that he has been unable to find a radula in animals of either Morum or Oniscidia, a feature similarly lacking in *M. (Oniscidia) bruuni*. Therefore the two groups share several important taxonomic critera and seem best regarded as subgenera of one genus.

A further subgenus of Morum is Herculea Hanley in H. & A. Adams, 1858 (H. & A. Adams 1853-58: 621), type species (by monotypy) Oniscia ponderosa Hanley, 1858 (Hanley 1858: 255, pl. 42, fig. 9, 10), previously recorded from the northwest Pacific only (figured by Habe 1964; pl. 21, fig. 1). Dall (1915: 86) and Olsson (1931: 95) considered one of the main distinguishing features of Herculea to be the relatively deep posterior sinus in the outer lip. Olsson (1931: 95, 97) recorded three fossil species of Morum from the Americas that he placed in Morum (Herculea): M domingense (G.B. Sowerby) (Sowerby 1850: 47, pl. 10, fig. 3) from Lower Miocene rocks of Santo Domingo, Panama, and Florida (Dall 1915: 86, pl. 12, fig. 28); M. maccormacki (Olsson) (Olsson 1928: 75, pl. 17, fig. 5, 6) from the basal Talara Formation (Upper Eocene) of Lagunitas, Peru; and M. charanalense Olsson (Olsson 1931: 97, pl. 17, fig. 1, 2) from the Mancora Formation (Oligocene) of Que. Charanal, Peru. These seem to be the only species to have been referred to Morum (Herculea) other than M. ponderosum. Morum maccormacki and M. charanalense are similar in their weak spiral sculpture, sharp-crested axial folds commencing abruptly at the periphery and leaving the shoulder smoothly concave, and deeply sinused posterior apertural lips. They seem closely related and possibly are correctly referred to M. (Herculea). However, M. domingense is a strongly cancellate species, compared with M (Oniscidia) dennisoni (Reeve) by Dall (1915: 86), that seems better placed in M. (Oniscidia) than in M. (Herculea). Therefore the relatively deep posterior sinus seems not to be restricted to M. (Herculea), and the distinguishing features of Herculea seem to be its weak spiral sculpture, and (on the type species, at least) its coarsely rugose inner lip.

Morum (Herculea) ponderosum (Hanley, 1858) can now be recorded from Australia, on the basis of specimens in the Australian Museum, Sydney, from Herald Cay and Lady Elliot Island, Queensland (W. F. Ponder, *in litt.*, 2 April 1976).

Subgenus Oniscidia Mörch, 1852

Oniscidia Mörch, 1852: 111. Type species (by monotypy): Oniscia cancellata G. B. Sowerby I, 1824, Recent, Indo-West Pacific (Valid, I.C.Z.N. Opinion 1040).

Oniscidea Olsson, 1931: 94 (incorrect subsequent spelling of Oniscidia Morch, 1852).

Onimusiro Kira, 1955: 43 (nomen nudum; not validated by Kira 1961: 51; 1962: 54; Habe 1964: 67).
Pulchroniscia Garrard, 1961: 16. Type species (by monotypy): Pulchroniscia delecta Garrard, 1961
(= Oniscidia bruuni Powell, 1958), Recent, New South Wales and Kermadec Islands.

Cancellomorum Emerson and Old, 1963: 18. Type species (by original designation): Oniscia grandis A. Adams, 1855, Recent, western Pacific.

Onimusiro Kira in Kuroda, Habe & Oyama, 1971: 198. Type species (by original designation): Oniscia grandis A. Adams, 1855.

The status of the name *Oniscidia* has long been in doubt, and recently was the subject of applications to the International Commission on Zoological Nomenclature by Cernohorsky (1972,

1973) and Maxwell and Beu (1973). Where first used by Swainson (1840: 299) the word is clearly a misspelling of Oniscia G. B. Sowerby I, 1824 (= Morum Roding, 1798). The International Commission on Zoological Nomeclature (1975) has recently published Opinion 1040 attributing the first valid usage of Oniscidia to Mörch (1952: 111), with type species Oniscia cancellata G. B. Sowerby I, 1824.

The problematical name Onimusiro Kira (nomen nudum) was discussed by Dance and Emerson (1967: 94-5). Kuroda, Habe and Oyama (1971, Japanese p. 198) validated the name when they attributed it to Kira and gave the following Japanese description: "The shell is upside down egg shaped rather than a spindle shape. On the surface of the shell, there are distinct vertical ridges crossing with spiral ridges and forming nodules. There are no [meaning unclear] ribs, Around the mouth of the shell there are smooth interior lips, with many folds on the smooth layers" (translation supplied by Translation Service, N.Z. Internal Affairs Dept.). The description is followed by a paragraph of comments on the status of the name and on the status of Oniscidia Mörch. The description and the clear designation of Oniscia grande A. Adams as type species (repeated in the English text, p. 130) make the name Onimusiro available from this authorship and date.

The name Pulchroniscia was proposed by Garrard (1961: 16) under a slight cloud also. Garrard gave adequate data by which he thought the genus could be distinguished from its relatives, stating: "Generic characters are the pyriform shape, acuminate spire, heavy reflected and denticulate outer lip, and strong axial plications". However, he did not expressly designate a type species, other than is implied by the heading "... gen. et sp. nov.", even although in 1969 he stated that the type had been selected by original designation ("O.T."; Garrard 1969: 9). However, he included only the species Pulchroniscia delecta Garrard, and as monotypy seems to be an adequate (although perhaps not desirable) manner of fixing a type species of a genus, Pulchroniscia Garrard, 1961 is regarded as an available name.

> Morum (Oniscidia) bruuni (Powell, 1958) Fig. 1 - 2, 4 - 5, 11-15

Oniscidia bruuni Powell 1958: 80, pl. 11, fig. 5. Pulchroniscia delecta Garrard 1961: 16, pl. 1, fig. 9a, 9b; Garrard 1969: 9.

Comparison of the holotype of Pulchroniscia delecta Garrard (Fig. 4, 5) with the live-collected specimen of Morum (Oniscidia) bruuni (Powell) (Fig. 1, 2) and with Powell's (1958: pl. 11, fig. 5) figure of the holotype of M. bruuni (in the "Galathea" collection, University Zoological Museum, Copenhagen) showed that all three are undoubtedly conspecific. The three specimens are of similar size and shape (although the holotype of Pulchroniscia delecta is slightly wider than the two Kermadec Islands shells), have identical sculpture on the inner lip and interior of the outer lip, and very similar dark brown parietal colour patches on the inner lip, although that of P. delecta is slightly paler than those of the Kermadec Islands specimens. All three have concave, narrow shoulders, lightly coronated by low spines formed on the axial folds where they are crossed by the uppermost spiral cord. There are 14 rather narrowly crested but relatively rounded and closely spaced axial folds on the last whorl and 15 on the penultimate whorl of P. delecta, 14 of identical shape on the last whorl and 16 on the penultimate whorl of the specimen in B S. 437, and "15 to 16 per whorl" (Powell 1958: 80) on the holotype of M. bruuni. The spiral sculpture consists of low, obsolescent cords crossing the axial folds, 11 and a further six fasciolar threads on the last whorl of the holotype of P. delecta, 11 and a further seven fasciolar threads on the specimen in B.S. 437, and 10 plus a further five fasciolar threads (Powell 1958: 80) on the holotype of M. bruuni. The colour pattern is similar on all three specimens; the weakly defined four darker spiral bands of the two Kermadec Islands shells are very faint on P. delecta, and represented mainly by colour patches behind the terminal varix; all three have faint, fine, closely spaced brown speckles on the abapertural surface of the terminal varix also (as do most species of Oniscidia). The surface of the shell is closely covered with thin, regularly spaced, axial lamellae in all specimens, although they are slightly less prominent on P. delecta than on the Kermadec Islands specimens Finally, all three have relatively tall, glossy protoconchs (Fig. 12, 15) of three lightly convex whorls. The slight differences between the holotype of P delecta and Kermadec Islands shells were undoubtedly caused by the New South Wales shell being a faded, slightly worn shell that had been dead longer than the Kermadec ones when it was collected

Localities: "Galathea" stn. 674, 29° 15'S, 177° 57'W, off Raoul I, Kermadecs 3.3. 1952, 75-85 m (holotype of M bruuni); dredged in 137 m, east of Botany Bay, New South Wales, M.V.



"Challenge" (holotype of Pulchroniscia delecta, Australian Museum, C.63343); BS437, brg. 3380 true, 3.2 naut. miles off Fleetwood Bluff, Raoul Island, 154 m, dredge on bottom 9 mins, R.V. "Acheron", 1975 (National Museum of N.Z., MF.25415).

Dimensions: height 32.5 mm, diameter 21.0 mm (holotype of M. bruuni); height 38.4 mm, diameter 25.1 mm (holotype of P. delecta); height 35.0 mm, diameter 22.4 mm (BS437).

Gross anatomy: The specimen from BS437, off Fleetwood Bluff, Raoul Island, was collected alive and fixed in formalin, and was preserved in ethanol when examined by the writer.

The operculum is disproportionately small, occupying the posterior third of the retracted foot only (Fig. 11), and has the nucleus near the centre of the right edge (in conventional spire-up orientation) and is of regularly oval shape, similar to operculae of Cassis and Galeodea. A narrow slit around the front of the foot is the opening of the pedal mucous gland. The animal was female, and a thick, wide oviduct is one of the most conspicuous features seen through the thin mantle. The foot is greyish white, maculated with numerous spots of black on dorsal and lateral surfaces, and the incurrent siphon is long and particularly finely maculated. The large cream ovary makes up most of the visible upper whorls.

Slitting and reflection of the mantle (Fig. 13) showed that the head also is disproportionately small and very little raised above the pedal muscle mass, with long, narrowly tapering tentacles that are maculated with black spots for most of their length and pale, translucent yellow at their tips. The eyes are relatively large. The hypobranchial gland is a very thin, cellular sheet, partly covering the oviduct, and became detached very readily (and thus is not shown in Fig. 13). The monopectinate, white ctenidium and bipectinate, grey osphradium are relatively large. The oviduct opens a short distance inside the mantle margin as a wide slit, suggesting that the egg capsules are large.

Opening the cephalic cavity by longitudinal dorsal incision (Fig. 14) revealed a gut configuration not previously reported in a cassid. The anterior oesophagus is wide, pale cream, and dorsoventrally compressed. The mid-oesophagus is wide, firm, thick-walled, pale pink, and conspicuously folded in the posterior half of the cephalic cavity. As there is no discrete oesophageal gland; the thickened mid-oesophagus wall is assumed to include the oesophageal gland. The proboscis sheath forms a large, oval, cream body which is attached to the wall of the cephalic cavity by a prominent row of densely spaced, short, cylindrical muscles attached around its posterior end. Opening the sheath by middorsal incision showed that its wall is relatively thin, and the proboscis is relatively wide and thickwalled, with a minutely reflected posterior tip, but lacks any discernible buccal apparatus including a radula. Two large, pale, flesh-pink salivary glands lie side by side immediately behind the proboscis sheath, filling the width of the cephalic cavity and obscuring the anterior oesophagus when in their natural position, and lacking recognisable accessory salivary glands. Their relatively very wide, white, translucent ducts join to pass sinuously up the right side of the proboscis sheath to its anterior end. The posterior oesophagus is extremely narrow, thin-walled and translucent, and passes back to the : smallest stomach the writer has observed in a tonnacean, with thin, translucent walls through which the minute internal pleats can be seen.

Thus Morum (Oniscidia) bruuni lacks any trace of a buccal apparatus or accessory salivary glands, and has an extremely narrow posterior oesophagus, an extremely small, thin-walled stomach, and a reduced oesophageal gland, but has a well-developed proboscis and anterior to mid-oesophagus. These features suggest that Morum (Oniscidia) feeds suctorially on the fluids of soft-bodied prey. so that a radula is unnecessary and the stomach need be only very small. The large salivary glands, with unusually wide, prominent ducts, may secrete enzymes that help liquify prey tissues.

FIGURES 1-10,

^{1-2,} Morum (Oniscidia) bruuni (Powell), collected alive off Fleetwood Bluff, Raoul I., Kermadec Islands; enlarged X 1.5; N.Z. National Museum, MF.25415.

^{3, 6-7, 10,} Morum (Oniscidia) finlayi (Laws), lower and middle Miocene specimens from Clifden, Southland, New Zealand, all enlarged X 1.5. Fig. 3. - North Bank, Clifden (Lillburnian); University of Canterbury Geology Department; Fig. 6, 7. - GS 11,210, Third Bay Sandstone, North Bank, Clifden (Lillburnian), N.Z. Geological Survey; Fig. 10. - GS 10,365, Long Beach Shellbed, Long Beach, Clifden (Altonian), N.Z. Geological Survey.

^{4-5,} Morum (Oniscidia) bruuni (Powell), holotype of Pulchroniscia delecta Garrard, dredged in 137 m, east of Botany Bay, New South Wales; enlarged X 1.5; Australian Museum, C.63343. 8-9, Morum (Oniscidia) grande (A. Adams), trawled in 270 m, off Mooloolaba, southern Queensland;

N.Z. Geological Survey, WM8347; natural size.



Morum (Oniscidia)

If the suggested feeding method is correct, it suggests that the very large sacular accessory salivary glands filling most of the cephalic cavity of almost all other Tonnacea secrete fluids that aid the radula in penetrating the test of the prey, in the case of cassids and *Charonia* that bore through the tests of echinoderms, or secrete anaesthetising fluids that help to remove their prey whole from tubes, in the case of Bursidae that feed on whole tubicolous polychaetes (Houbrick and Fretter 1969: 424).

All other cassids whose feeding has been described seem to feed exclusively on echinoderms, and almost all on echinoids (see references in Beu et al. 1972: 283; Hughes and Hughes 1971) which, having hard tests, must be perforated with the aid of a radula. Therefore it may be speculated that Morum and its subgenera feed on soft-bodied echinoderms such as holothurians.

Relationships

Dance and Emerson (1967: 96) placed Pulchroniscia Garrard tentatively in Morum, "in the absence of knowledge of the soft parts". Dr. W. K. Emerson (in litt., 1 Sept. 1972) stated that he had been unable to find a radula in animals of either Morum or Oniscidia, and considered that the relationships of Pulchroniscia delecta would not be clear until it was known whether it, too, lacked a radula. The lack of a radula in the present specimen of Morum (Oniscidia) bruuni (= Pulchroniscia delecta) shows that there are no known anatomical differences between Morum (Oniscidia) and the type species of Pulchroniscia.

Morum (Oniscidia) bruuni differs from the larger, more coarsely cancellate, typical species of Oniscidia, such as M. grande (A. Adams), M. cancellatum (G. B. Sowerby I) and M. uchiyamai Kuroda and Habe, in its slightly smaller size, slightly shorter last whorl, lower and more rounded axial folds causing less prominent shoulder spines, less prominent thin axial lamellae, weaker sculpture on the inner lip, slightly taller protoconch of three rather than one and a half to two whorls and, most noticeably, by its markedly weaker spiral cords. The many fossil species from New Zealand and Europe and a few living species such as M. macandrewi (G. B. Sowerby III) are intermediate in all these features between M. grande and M. bruuni. It is suggested below that the New Zealand Miocene M. finlayi (Laws) was ancestral to M. bruuni, so that there can be little doubt that the distinguishing features of Pulchroniscia are of specific rank only. Pulchroniscia Garrard, 1961 is synonymised with Oniscidia Mörch, 1852.

The New Zealand Lower and Middle Miocene species Morum (Oniscidia) finlayi (Laws) (Fig. 3, 6, 7, 10) is known by about 15 specimens from several Altonian to Lillburnian horizons at Clifden, Southland, as well as rarely at a few other Lower Miocene localities. It differs from M. bruuni in having slightly more prominent axial folds and axial lamellae and markedly more prominent and more rounded spiral cords, but the two species are similar enough in shape, size, inner and outer lip sculpture, and numbers of axial folds to suggest that M. bruuni may have evolved directly from M. finlayi. Other, older species are known from New Zealand (P. A. Maxwell, N.Z. Geological Survey, pers. comm.) but none are known from younger rocks to help clarify the lineage of M. finlayi after Middle Miocene time.

FIGURES 11-15.

11, 13-14. Morum (Oniscidia) bruuni (Powell), off Fleetwood Bluff, Raoul Island, Kermadec Islands (N.Z. National Museum, MF25415; shell in Fig. 1, 2, 12), sketches of external appearance and anterior gut configuration. Fig. 11. — external appearance of contracted whole animal removed from shell, X3. Fig. 13. — anterior portion of animal, with mantle opened mid-dorsally to show head and major organs of mantle cavity, X5. Fig. 14. — cephalic cavity opened by mid-dorsal incision, to show configuration of anterior part of gut (foot, mantle organs, etc., not shown), X7.

12, 15. Morum (Oniscidia) bruuni (Powell), protoconchs enlarged X33. Fig. 12. — off Fleetwood Bluff, Raoul Island, Kermadec Islands, apex slightly eroded. Fig. 15. — holotype of Pulchroniscia delecta Garrard, off Botany Bay, New South Wales, apex and left side slightly eroded.

Abbreviations: c - ctenidium; ct - cephalic tentacle; e - eye; f - foot; hg - hypobranchial gland; m - mantle (slit and reflected); mo - glandular area of mid-oesophagus; o - ovary; od - oviduct; oo - opening of oviduct; opg - opening of pedal gland; opm - operculum; os - osphradium; p - proboscis; ps - proboscis sheath (slit mid-dorsally); rm - retractor muscles around base of proboscis sheath (semidiagrammatic); s - siphon; sd - salivary ducts; sg - salivary gland; wcc - wall of cephalic cavity (slit and reflected).

Morum (Oniscidia) grande (A. Adams, 1855)

Fig. 8-9

Oniscia grandis: A. Adams 1855: 185.

Lambidium grande: Yen 1942: 214, pl. 17, fig. 104 (lectotype).

Morum (Onimusiro) grande: Kira 1962: 54, pl. 22, fig. 1.

Oniscia cancellata: Coleman 1975: 263, fig. 718 (not Oniscia cancellata G. B. Sowerby I, 1824). This large, tall-spired, strongly cancellate species was recorded informally from Australia by Garrard (1961: 16), as Oniscidia cancellata, "recently trawled in Queensland". Although Australian specimens have been figured only by Coleman (1975: 263, fig. 718), under the name Oniscia cancellata, the shell is one of the well-known, much sought after collectors' treasures of southern Queensland, and there are probably more specimens in private than in Museum collections, apparently all bearing the name M. cancellatum. A specimen in the N.Z. Geological Survey (WM8347), trawled off Mooloolaba, southern Queensland, in 270 m, is a large, tall shell (height 71.2 mm, diameter 42.7 mm) with a tall spire, narrow spiral cords, very long last whorl, and broadly reflected outer lin. agreeing in all details with the lectotype of M. grande figured by Yen (1942: pl. 17, fig. 104). Morum (Oniscidia) cancellatum (G. B. Sowerby I, 1824) is a smaller, shorter-spired shell with more widely spaced spiral cords and a narrower outer lip than in M. grande, and is apparently rare and recorded only from the northwest Pacific Another northwest Pacific species, M. (Oniscidia) uchivamai Kuroda and Habe (Habe 1964: pl. 20, fig. 3) resembles M. grande closely but has higher and more densely spaced axial lamellae and markedly wider and more closely spaced spiral cords. All Australian specimens appear to belong in M. (Oniscidia) grande. Other Australian localities are: 145 m, off Cape Moreton, Queensland (W. J. Paul Collection, Wellington); 114-124 m, N.E. of Cape Moreton, Queensland, ex T.A. Garrard colln., Australian Museum, C.95296 (2 specimens).

In summary, the known Southwest Pacific species of Morum are listed: Morum (Oniscidia) bruuni (Powell, 1958), New South Wales to the Kermadec Islands.

Morum (Oniscidia) grande (A. Adams, 1855), Queensland (north to Japan).

Morum (Herculea) ponderosum (Hanley, 1858), Queensland (north to Japan).

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